

WHAT IS CLAIMED IS:

1. A device for photographing an image of a subject, comprising:

5 a solid-state imaging device which has an imaging surface composed of a large number of pixel elements struck by light rays from the subject, which includes a charge accumulating section for converting the incident light rays into charges by the pixel elements and accumulating the charges, a charge transfer section for receiving the charges from the charge accumulating section and transferring them, and a output section for outputting the transferred charges as an image signal;

10 driving means which generates a normal driving signal in a normal driving mode to drive the accumulating section and the transfer section for transferring the charges accumulated in the charge accumulating section to the charge transfer section at a normal transfer rate and causing the imaging device to output the image signal from the output section, and
15 which further generates a charge discharging signal for discharging the charges from the charge accumulating section outside the imaging device and a high transfer rate driving signal for transferring the charges in the charge transfer section at a high transfer rate higher
20 than the normal transfer rate in a charge discharge mode;

optical shutter means which is capable of

switching between an opening mode that permits light rays to impinge on the imaging surface of the imaging device and a closing mode that inhibits light rays from impinging on the imaging surface, the optical shutter having a delay in switching from the closing mode to the opening mode or from the opening mode to the closing mode; and

exposure control means for controlling the amount of light rays that reaches the imaging surface by controlling the driving means and shutter means, wherein

the exposure control means switches the shutter means to the closing mode at a first time in response to the start in photographing the image of the subject,

causes the driving means to start to supply the charge discharging signal to the imaging device at the first time, thereby discharging the accumulated charges from the accumulating section to the outside of the imaging device in the charge discharge mode,

causes the driving means to start to supply a high transfer rate driving signal to the imaging device at the first time, thereby driving the charge transfer section at high transfer rate for a specific period, the charges being transferred in the charge transfer section to the outside of the imaging device via the output section in the charge discharge mode,

causes the driving means to stop supplying the

high transfer rate driving signal to the imaging device at a second time, thereby stopping the driving of the charge transfer section,

switches the shutter means from the closing mode to the opening mode after the second time and keeps the shutter means in the opening mode after a third time,

causes the driving means to stop supplying the charge discharging signal to the imaging device at a time substantially equal to or before the third time and the charge accumulating section to start to accumulate charges,

switches the shutter means to the closing mode at a fourth time within a exposure period from the third time, and

causes the driving means to supply a normal driving signal to the imaging device at a fifth time, until when the shutter means has been kept in the closing mode since the fourth time, thereby driving the charge transfer section in the normal driving mode, which causes the charge transfer section to output an image signal outside the imaging device.

2. The device according to claim 1, wherein the fourth time almost coincides with the exposure period from the third time, and

the fifth time coincides with the time when a delay of dt in the optical shutter means has elapsed since the fourth time.

3. The device according to claim 1, wherein the fourth time is set before the exposure period has elapsed since the third time, the exposure period ending before the delay in the optical shutter means has elapsed since the fourth time.

4. The device according to claim 3, wherein the exposure control means causes the driving means to supply a high transfer rate driving signal to the imaging device at a sixth time that the delay in the optical shutter means has elapsed since the fourth time, thereby driving the charge transfer section at high transfer rate for a second specific period, which discharges the charges from the charge transfer section to the outside of the imaging device, and at the fifth time that the second specific period of the high transfer rate driving has elapsed, causes the driving means to supply a normal driving signal to the imaging device, thereby driving the charge transfer section in the normal driving mode, which causes the charge transfer section to output an image signal outside the imaging device.

5. A device for photographing an image of a subject, comprising:

a solid-state imaging device which has an imaging surface composed of a large number of pixel elements struck by light rays from the subject, which includes a charge accumulating section for converting the incident

light rays into charges by the pixel elements and
accumulating the charges, a charge transfer section for
receiving the charges from the charge accumulating
section and transferring them, and a output section for
5 outputting the transferred charges as an image signal;

driving means which generates a normal driving
signal in a normal driving mode to drive the
accumulating section and the transfer section for
transferring the charges accumulated in the charge
10 accumulating section to the charge transfer section at
a normal transfer rate and causing the imaging device
to output the image signal from the output section, and
which further generates a charge discharging signal for
discharging the charges from the charge accumulating
15 section outside the imaging device and a high transfer
rate driving signal for transferring the charges in the
charge transfer section at a high transfer rate higher
than the normal transfer rate in a charge discharge
mode;

20 optical shutter means which is capable of
switching between an opening mode that permits light
rays to impinge on the imaging surface of the imaging
device and a closing mode that inhibits light rays from
impinging on the imaging surface, the optical shutter
25 having a delay in switching from the closing mode to
the opening mode or from the opening mode to the
closing mode; and

exposure control means which controls the amount of light rays that reaches the imaging surface by controlling the driving means and shutter means and includes means for determining an exposure time and
5 means for comparing the determined exposure time with a reference exposure time and setting one of a first and a second photographic mode, wherein, in the first photographic mode,

the exposure control means switches the shutter
10 means to the closing mode at a first time in response to the start in photographing the image of the subject,

causes the driving means to start to supply the charge discharging signal to the imaging device at the first time, thereby discharging the accumulated charges
15 from the accumulating section to the outside of the imaging device in the charge discharge mode,

causes the driving means to start to supply a high transfer rate driving signal to the imaging device at the first time, thereby driving the charge transfer
20 section at high transfer rate for a first specific period, the charges being transferred in the charge transfer section to the outside of the imaging device via the output section in the charge discharge mode,

causes the driving means to stop supplying the
25 high transfer rate driving signal to the imaging device at a second time, thereby stopping the driving of the charge transfer section,

switches the shutter means from the closing mode to the opening mode after the second time and keeps the shutter means in the opening mode after a third time,

causes the driving means to stop supplying the charge discharging signal to the imaging device at a time substantially equal to or before the third time and the charge accumulating section to start to accumulate charges,

switches the shutter means to the closing mode at a fourth time within the exposure time from the third time, and

causes the driving means to supply a normal driving signal to the imaging device at a fifth time, until when the shutter means has been kept in the closing mode since the fourth time, thereby driving the charge transfer section in the normal driving mode, which causes the charge transfer section to output an image signal outside the imaging device;

in the second photographic mode, the exposure control means switches the shutter means to the closing mode at the first time in response to the start in photographing the image of the subject,

causes the driving means to start to supply a charge discharging signal to the imaging device at the first time, thereby discharging the accumulated charges from the charge accumulating section to the outside of the imaging device,

causes the driving means to start to supply a high transfer rate driving signal to the imaging device at the first time, thereby driving the charge transfer section at high transfer rate for a second specific period, which transfers the charges in the charge transfer section outside the imaging device,

causes the driving means to stop supplying the high transfer rate driving signal to the imaging device at the second time, thereby stopping the driving of the charge transfer section,

switches the shutter means from the closing mode to the opening mode after the second time and keeps the shutter means in the opening mode at the third time,

causes the driving means to stop supplying the charge discharging signal to the imaging device at the third time and the charge accumulating section to start to accumulate charges,

switches the shutter means to the closing mode at the fourth time that the exposure time has elapsed since the third time, the exposure time ending before the delay dt in the optical shutter means has elapsed since the fourth time, and

causes the driving means to supply a high transfer rate driving signal to the imaging device at the sixth time that the delay dt in the optical shutter means has elapsed since the fourth time, thereby driving the charge transfer section at high transfer rate for a

third specific period and discharging the charges in the charge transfer section to the outside of the imaging device, and at the fifth time that the specific period of the high transfer rate driving has elapsed, causes the driving means to supply a normal driving signal to the imaging device, thereby driving the charge transfer section in the normal mode, which causes the charge transfer section to output an image signal outside the imaging device.

6. The device according to claim 5, wherein the reference exposure time is set to $TC = dt/2$ to $2dt$, where dt means a delay in the optical shutter means.

7. The device according to claim 6, wherein the first photographic mode is set when the specific exposure time T_s fulfills the expression $T_s < TC$, whereas the second photographic mode is set when the specific exposure time T_s fulfills the expression $T_s \geq TC$.

8. The device according to claim 5, wherein the reference exposure time is set at 1.4 ms.

9. The device according to claim 5, wherein the period from the first time to second time is set at $1T_{fr}/X$ or more, during which period the driving means supplies the high transfer rate driving signal to the imaging device, thereby driving the charge transfer section at high transfer rate for the first specific period, which transfers the charges from the charge

transfer section to the outside of the imaging device,
where X means a multiple of the high transfer rate
transfer rate with respect to the normal transfer rate
and 1Tfr means a read period for one screen.

5 10. A method of controlling the amount of light
rays that reaches an imaging surface by controlling
driving means and shutter means in an image pickup
device including

10 a solid-state imaging device which has an imaging
surface composed of a large number of pixel elements
struck by light rays from the subject, which includes a
charge accumulating section for converting the incident
light rays into charges by the pixel elements and
accumulating the charges, a charge transfer section for
15 receiving the charges from the charge accumulating
section and transferring them, and a output section for
outputting the transferred charges as an image signal;

 driving means which generates a normal driving
signal in a normal driving mode to drive the
20 accumulating section and the transfer section for
transferring the charges accumulated in the charge
accumulating section to the charge transfer section at
a normal transfer rate and causing the imaging device
to output the image signal from the output section, and
25 which further generates a charge discharging signal for
discharging the charges from the charge accumulating
section outside the imaging device and a high transfer

rate driving signal for transferring the charges in the charge transfer section at a high transfer rate higher than the normal transfer rate in a charge discharge mode; and

5 optical shutter means which is capable of switching between an opening mode that permits light rays to impinge on the imaging surface of the imaging device and a closing mode that inhibits light rays from impinging on the imaging surface, the optical shutter
10 having a delay in switching from the closing mode to the opening mode or from the opening mode to the closing mode, the method comprising the steps of:

 switching the shutter means to the closing mode at a first time in response to the start in photographing
15 the image of the subject,

 causing the driving means to start to supply a charge discharging signal to the imaging device at the first time, thereby discharging the accumulated charged from the charge accumulating section to the outside of
20 the imaging device,

 causing the driving means to start to supply a high transfer rate driving signal to the imaging device at the first time, thereby driving the charge transfer section at high transfer rate for a specific period or
25 longer, which transfers the charges in the charge transfer section outside the imaging device,

 causing the driving means to stop supplying the

high transfer rate driving signal to the imaging device at a second time, thereby stopping the driving of the charge transfer section,

5 switching the shutter means from the closing mode to the opening mode after the second time and keeping the shutter means in the opening mode at a third time,

causing the driving means to stop supplying the charge discharging signal to the imaging device at a time substantially equal to or before the third time
10 and the charge accumulating section to start to accumulate charges,

switching the shutter means to the closing mode at a fourth time within a exposure time from the third time, and

15 causing the driving means to supply a normal driving signal to the imaging device at a fifth time, until when the shutter means has been kept in the closing mode since the fourth time, thereby driving the charge transfer section in the normal driving mode,
20 which causes the charge transfer section to output an image signal outside the imaging device.

11. The method according to claim 10, wherein the fourth time almost coincides with the exposure period from the third time, and

25 the fifth time coincides with the time when a delay of dt in the optical shutter means has elapsed since the fourth time.

12. The method according to claim 10, wherein the fourth time is set before the exposure period has elapsed since the third time, the exposure period ending before the delay in the optical shutter means has elapsed since the fourth time.

13. The method according to claim 12, wherein the exposure control means causes the driving means to supply a high transfer rate driving signal to the imaging device at a sixth time that the delay in the optical shutter means has elapsed since the fourth time, thereby driving the charge transfer section at high transfer rate for a specific period, which discharges the charges from the charge transfer section to the outside of the imaging device, and at the fifth time that the specific period of the high transfer rate driving has elapsed, causes the driving means to supply a normal driving signal to the imaging device, thereby driving the charge transfer section normally, which causes the charge transfer section to output an image signal outside the imaging device.

14. A method of controlling the amount of light that reaches an imaging surface by controlling driving means and shutter means in an image pickup device including

a solid-state imaging device which has an imaging surface composed of a large number of pixel elements struck by light rays from the subject, which includes a

charge accumulating section for converting the incident light rays into charges by the pixel elements and accumulating the charges, a charge transfer section for receiving the charges from the charge accumulating section and transferring them, and a output section for outputting the transferred charges as an image signal;

driving means which generates a normal driving signal in a normal driving mode to drive the accumulating section and the transfer section for transferring the charges accumulated in the charge accumulating section to the charge transfer section at a normal transfer rate and causing the imaging device to output the image signal from the output section, and which further generates a charge discharging signal for discharging the charges from the charge accumulating section outside the imaging device and a high transfer rate driving signal for transferring the charges in the charge transfer section at a high transfer rate higher than the normal transfer rate in a charge discharge mode; and

optical shutter means which is capable of switching between an opening mode that permits light rays to impinge on the imaging surface of the imaging device and a closing mode that inhibits light rays from impinging on the imaging surface, the optical shutter having a delay in switching from the closing mode to the opening mode or from the opening mode to the

closing mode,

the method comprising the steps of

determining an exposure time;

comparing the determined exposure time with a

5 reference exposure time and setting one of a first and
a second photographic mode;

in the first photographic mode,

switching the shutter means to the closing mode at
a first time in response to the start in photographing
10 the image of the subject,

causing the driving means to start to supply a
charge discharging signal to the imaging device at the
first time, thereby discharging the accumulated charged
from the charge accumulating section to the outside of
15 the imaging device,

causing the driving means to start to supply a
high transfer rate driving signal to the imaging device
at the first time, thereby driving the charge transfer
section at high transfer rate for a specific period or
20 longer, which transfers the charges in the charge
transfer section outside the imaging device,

causing the driving means to stop supplying the
high transfer rate driving signal to the imaging device
at a second time, thereby stopping the driving of the
25 charge transfer section,

switching the shutter means from the closing mode
to the opening mode after the second time and keeping

the shutter means in the opening mode at a third time,

causing the driving means to stop supplying the charge discharging signal to the imaging device at a time substantially equal to or before the third time

5 and the charge accumulating section to start to accumulate charges,

switching the shutter means to the closing mode at a fourth time within a exposure time from the third time, and

10 causing the driving means to supply a normal driving signal to the imaging device at a fifth time, until when the shutter means has been kept in the closing mode since the fourth time, thereby driving the charge transfer section in the normal driving mode,
15 which causes the charge transfer section to output an image signal outside the imaging device; and

in the second photographic mode,

switching the shutter means to the closing mode at the first time in response to the start in
20 photographing the image of the subject;

causing the driving means to start to supply a charge discharging signal to the imaging device at the first time, thereby discharging the accumulated charges from the charge accumulating section to the outside of
25 the imaging device;

causing the driving means to start to supply a high transfer rate driving signal to the imaging device

at the first time, thereby driving the charge transfer section at high transfer rate for a specific period or longer, which transfers the charges in the charge transfer section outside the imaging device;

5 causing the driving means to stop supplying the high transfer rate driving signal to the imaging device at the second time, thereby stopping the driving of the charge transfer section;

10 switching the shutter means from the closing mode to the opening mode after the second time and keeping the shutter means in the opening mode at the third time;

15 causing the driving means to stop supplying the charge discharging signal to the imaging device at a time substantially equal to or before the third time and the charge accumulating section to start to accumulate charges;

20 switching the shutter means to the closing mode at the fourth time that the exposure period has elapsed since the third time, the exposure period ending before the delay dt in the optical shutter means has elapsed since the fourth time; and

25 causing the driving means to supply a high transfer rate driving signal to the solid-state image pickup device at the sixth time that the delay dt in the optical shutter means has elapsed since the fourth time, thereby driving the charge transfer section at

high transfer rate for a specific period or longer and discharging the charges in the charge transfer section to the outside of the imaging device, and at the fifth time that the specific period of the high transfer rate driving has elapsed, causing the driving means to supply a normal driving signal to the imaging device, thereby driving the charge transfer section normally, which causes the charge transfer section to output an image signal outside the imaging device.

15. The method according to claim 14, wherein the reference exposure time is set to $TC = dt/2$ to $2dt$, where dt means a delay in the optical shutter means.

16. The method according to claim 14, wherein the first photographic mode is set when the specific exposure time T_s fulfills the expression $T_s < TC$, whereas the second photographic mode is set when the specific exposure time T_s fulfills the expression $T_s \geq TC$.

17. The method according to claim 14, wherein the reference exposure time is set at 1.4 ms.

18. The method according to claim 14, wherein the period from the first time to second time is set at $1T_{fr}/X$ or more, during which period the driving means supplies the high transfer rate driving signal to the imaging device, thereby driving the charge transfer section at high transfer rate for a specific period or longer, which transfers the charges from the charge

transfer section outside the imaging device, where X means a multiple of the high transfer rate transfer rate with respect to the normal transfer rate and $1T_{fr}$ means a read period for one screen.

5 19. A device for photographing an image of a subject, comprising:

 a solid-state imaging device including a charge
accumulating section on which the image is projected,
for converting the image into charges and accumulating
10 the charges, a charge transfer section for receiving
the accumulated charges from the charge accumulating
section and transferring them, and a output section for
outputting the transferred charges as an image signal;

 driving means for driving the charge accumulating
15 section to accumulate the charges, the charge transfer
section to transfer the charges from the charge
accumulating section to the output section via the
transfer section at a normal transfer rate, and the
outputting section to output the image signal in a
20 normal driving mode;

 optical shutter means which is capable of
switching between an opening mode for permitting the
image to project the image on the accumulating section
and a closing mode for inhibiting the image from being
25 projected on the accumulating section, the optical
shutter means having a delay in switching from the
closing mode to the opening mode or from the opening

mode to the closing mode; and

exposure control means for controlling the driving means and the shutter means, wherein

the exposure control means switches the shutter means to the closing mode,

causes the driving means to start to discharge the charges from the accumulating section to the outside the imaging device,

causes the driving means to drive the charge transfer section at a high transfer rate during a predetermined period, which transfers the charges in the charge transfer section to the outside the imaging device,

causes the driving means to stop the transfer of the charges in the charge transfer section,

switches the shutter means from the closing mode to the opening mode,

causes the driving means to stop the discharge of the charges from the accumulating section,

causes the driving means to the accumulating section to start to accumulate charges during a predetermined exposure period,

switches the shutter means to the closing mode, and

causes the driving means to drive the charge transfer section in the normal mode, and to output an image signal from the output section.

20. The device according to claim 19, wherein the predetermined exposure period is defined between the stop of the discharge and the start of switching the shutter mean to the closing mode.

5 21. The device according to claim 19, wherein the exposure control means causes the driving means to drive the charge transfer section at high transfer rate during a predetermined transfer period after the shutter means is switched in the closing mode, and

10 causing the driving means to drive the accumulating section and the charge transfer section after the predetermined transfer period.

22. A device for photographing an image of a subject, comprising:

15 a solid-state imaging device including a charge accumulating section on which the image is projected, for converting the image into charges and accumulating the charges, a charge transfer section for receiving the accumulated charges from the charge accumulating section and transferring them, and a output section for outputting the transferred charges as an image signal;

20

 driving means for driving the charge accumulating section to accumulate the charges, the charge transfer section to transfer the charges from the charge accumulating section to the output section via the transfer section at a normal transfer rate, and the outputting section to output the image signal in a

25

normal driving mode;

optical shutter means which is capable of switching between an opening mode for permitting the image to project the image on the accumulating section and a closing mode for inhibiting the image from being projected on the accumulating section, the optical shutter means having a delay in switching from the closing mode to the opening mode or from the opening mode to the closing mode; and

exposure control means for controlling the driving means and the shutter means and including means for determining an exposure time and means for comparing the determined exposure time with a reference exposure time and setting one of a first and a second photographic mode, wherein, in the first photographic mode,

the exposure control means switches the shutter means to the closing mode,

causes the driving means to start to discharge the charges from the accumulating section to the outside the imaging device,

causes the driving means to drive the charge transfer section at a high transfer rate during a predetermined period, which transfers the charges in the charge transfer section to the outside the imaging device,

causes the driving means to stop the transfer of

the charges in the charge transfer section,

switches the shutter means from the closing mode
to the opening mode,

causes the driving means to stop the discharge of
5 the charges from the accumulating section,

causes the driving means to the accumulating
section to start to accumulate charges during a
predetermined exposure period,

switches the shutter means to the closing mode,
10 and

causes the driving means to drive the charge
transfer section in the normal mode, and to output an
image signal from the output section, and

in the second photographic mode,
15 the exposure control means switches the shutter
means to the closing mode,

causes the driving means to start to discharge the
charges from the accumulating section to the outside
the imaging device,

causes the driving means to drive the charge
20 transfer section at a high transfer rate during a
predetermined period, which transfers the charges in
the charge transfer section to the outside the imaging
device,

causes the driving means to stop the transfer of
25 the charges in the charge transfer section,

switches the shutter means from the closing mode

to the opening mode,

causes the driving means to stop the discharge of the charges from the accumulating section,

causes the driving means to the accumulating
5 section to start to accumulate charges during a predetermined exposure period,

switches the shutter means to the closing mode,

causes the driving means to drive the charge transfer section in the normal mode, and to output an
10 image signal from the output section,

causes the driving means to drive the charge transfer section a high transfer rate during a predetermined transfer period after the shutter means is switched in the closing mode, and

15 causing the driving means to drive the accumulating section and the charge transfer section after the predetermined transfer period in the normal transfer mode.

23. The device according to claim 22, wherein the
20 reference exposure time is set to $TC = dt/2$ to $2dt$, where dt means a delay in the optical shutter means.

24. The device according to claim 23, wherein the first photographic mode is set when the specific exposure time T_s fulfills the expression $T_s < TC$,
25 whereas the second photographic mode is set when the specific exposure time T_s fulfills the expression $T_s \geq TC$.

25. The device according to claim 23, wherein the reference exposure time is set at 1.4 ms.

26. A method of controlling a device for photographing an image of a subject, the device comprising:

5 a solid-state imaging device including a charge accumulating section on which the image is projected, for converting the image into charges and accumulating the charges, a charge transfer section for receiving
10 the accumulated charges from the charge accumulating section and transferring them, and a output section for outputting the transferred charges as an image signal;

driving means for driving the charge accumulating section to accumulate the charges, the charge transfer
15 section to transfer the charges from the charge accumulating section to the output section via the transfer section at a normal transfer rate, and the outputting section to output the image signal in a normal driving mode; and

20 optical shutter means which is capable of switching between an opening mode for permitting the image to project the image on the accumulating section and a closing mode for inhibiting the image from being projected on the accumulating section, the optical
25 shutter means having a delay in switching from the closing mode to the opening mode or from the opening mode to the closing mode;

the method comprising steps of
switching the shutter means to the closing mode,
causing the driving means to start to discharge
the charges from the accumulating section to the
5 outside the imaging device,

causing the driving means to drive the charge
transfer section at a high transfer rate during a
predetermined period, which transfers the charges in
the charge transfer section to the outside the imaging
10 device,

causing the driving means to stop the transfer of
the charges in the charge transfer section,

switching the shutter means from the closing mode
to the opening mode,

15 causing the driving means to stop the discharge of
the charges from the accumulating section,

causing the driving means to the accumulating
section to start to accumulate charges during a
predetermined exposure period,

20 switching the shutter means to the closing mode,
and

causing the driving means to drive the charge
transfer section in the normal mode, and to output an
image signal from the output section.

25 27. The method according to claim 26, wherein the
predetermined exposure period is defined between the
stop of the discharge and the start of switching the

shutter mean to the closing mode.

28. The method according to claim 26, further including a step of causing the driving means to drive the charge transfer section at high transfer rate during a predetermined transfer period after the shutter means is switched in the closing mode, and causing the driving means to drive the accumulating section and the charge transfer section after the predetermined transfer period.

29. A method of controlling a device for photographing an image of a subject, the device comprising:

a solid-state imaging device including a charge accumulating section on which the image is projected, for converting the image into charges and accumulating the charges, a charge transfer section for receiving the accumulated charges from the charge accumulating section and transferring them, and an output section for outputting the transferred charges as an image signal;

driving means for driving the charge accumulating section to accumulate the charges, the charge transfer section to transfer the charges from the charge accumulating section to the output section via the transfer section at a normal transfer rate, and the outputting section to output the image signal in a normal driving mode; and

optical shutter means which is capable of

switching between an opening mode for permitting the image to project the image on the accumulating section and a closing mode for inhibiting the image from being projected on the accumulating section, the optical shutter means having a delay in switching from the closing mode to the opening mode or from the opening mode to the closing mode;

the method comprising steps of

comparing the determined exposure time with a reference exposure time; and

setting one of a first and a second photographic mode,

wherein, in the first photographic mode,

switching the shutter means to the closing mode,

causing the driving means to start to discharge the charges from the accumulating section to the outside the imaging device,

causing the driving means to drive the charge transfer section at a high transfer rate during a predetermined period, which transfers the charges in the charge transfer section to the outside the imaging device,

causing the driving means to stop the transfer of the charges in the charge transfer section,

switching the shutter means from the closing mode to the opening mode,

causing the driving means to stop the discharge of

the charges from the accumulating section,

causing the driving means to the accumulating section to start to accumulate charges during a predetermined exposure period,

5 switching the shutter means to the closing mode, and

causing the driving means to drive the charge transfer section in the normal mode, and to output an image signal from the output section;

10 in the second photographing mode, switching the shutter means to the closing mode, causing the driving means to start to discharge the charges from the accumulating section to the outside the imaging device,

15 causing the driving means to drive the charge transfer section at a high transfer rate during a predetermined period, which transfers the charges in the charge transfer section to the outside the imaging device,

20 causing the driving means to stop the transfer of the charges in the charge transfer section,

switching the shutter means from the closing mode to the opening mode,

causing the driving means to stop the discharge of the charges from the accumulating section,

25 causing the driving means to the accumulating section to start to accumulate charges during a

predetermined exposure period,

switching the shutter means to the closing mode,
causing the driving means to drive the charge
transfer section in the normal mode, and to output an
5 image signal from the output section,

causing the driving means to drive the charge
transfer section a high transfer rate during a
predetermined transfer period after the shutter means
is switched in the closing mode, and

10 causing the driving means to drive the
accumulating section and the charge transfer section
after the predetermined transfer period in the normal
transfer mode.

30. The method according to claim 29, wherein the
15 reference exposure time is set to $TC = dt/2$ to $2dt$,
where dt means a delay in the optical shutter means.

31. The method according to claim 30, wherein the
first photographic mode is set when the specific
exposure time T_s fulfills the expression $T_s < TC$,
20 whereas the second photographic mode is set when the
specific exposure time T_s fulfills the expression $T_s \geq$
TC.

32. The method according to claim 29, wherein the
reference exposure time is set at 1.4 ms.

25 33. Electronic imaging apparatus comprising:
a solid-state imager;
an imager driver, coupled to said imager, for

outputting imager drive pulse to drive said imager,
said imager drive pulses at least include a transfer
gate pulse, a Vsub pulse train, and a VCCD pulse train;

5 a mechanical shutter, arranged in front of said
imager, for switching incident light rays directing to
said imager;

a shutter driver, coupled to said shutter, for
outputting shutter drive pulses to switch said shutter
between open and closed state; and

10 a controller for controlling said imager driver
and said shutter driver according to an exposure
sequence,

wherein the controller

causing said shutter driver to switch said shutter
15 to closed state prior to beginning an exposure of said
imager,

causing said imager driver to apply said V_{sub}
pulse train and said VCCD pulse train,

causing said shutter driver to switch said shutter
20 to open state,

causing said imager driver to terminate outputting
the VCCD pulse train, after said shutter switched to
fully open,

causing either said imager driver to apply said
25 transfer gate pulse to said imager or said shutter
driver to switch said shutter to close, and

reading out an image signal from said imager while

keeping said shutter closed.

34. Method of controlling exposure of an electronic imaging apparatus at least having a pulse driven solid-state imager and a mechanical shutter, the method comprising steps of:

closing the shutter prior to beginning an exposure of said imager;

applying drive pulse to said imager, said drive pulse includes V_{sub} trains and VCCD pulse train;

opening the shutter;

terminating the VCCD pulse train;

starting exposure by terminating the V_{sub} pulse train after said shutter switched to fully open;

terminating exposure by either applying a TG pulse to said imager or closing said shutter; and

reading out an image signal from said imager while keeping said shutter closed.